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Longitudinal Beam Diagnostics Using Streak Camera Imaging

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The development of accelerator-based light sources relies heavily on accurate beam diagnostics to ensure high beam quality for scientific users. This work presents longitudinal beam diagnostics performed with streak camera imaging at the Budker Institute of Nuclear Physics, with application to different facilities at the Institute. Using picosecond resolution, streak cameras enable direct measurement of bunch length, timing jitter, and beam profile deformation. At NovoFEL, the dependence of bunch length on RF phase was studied; at VEPP-4M, intrinsic energy spread was measured; and for the Microtron, bunch spacing and macropulse structure in the optical range were analyzed. These results demonstrate the critical role of time-resolved diagnostics in maintaining beam stability and optimizing accelerator performance. Such methods are directly relevant for the design and operation of future African light sources, supporting reliable and efficient delivery of high-quality beams for regional and international research communities.

Primary author: MAISHANU, Ibrahim (Budker Institute of Nuclear Physics)

Co-author: BORIN, Vladislav (Budker Institute of Nuclear Physics)

Presenter: MAISHANU, Ibrahim (Budker Institute of Nuclear Physics)

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